

Results of Treatment of Distal Radius Fracture in Geriatrics Patients Using Closed Reduction and Percutaneous K-Wires Fixation

Hesham Hamed Refai, Morsy Mohammed Basony, Moataz Bellah Yousef Salh Ahmed*

Department of Orthopedic Surgery, Aswan University, Egypt

*Corresponding Author: Moataz Bellah Yousef Salh Ahmed, Phone: 01114423341, Email: motaz.yousef@gmail.com

ABSTRACT

Background: distal radius fractures are a common fracture among geriatric population. Requiring comprehensive understanding of fracture anatomy and comprehensive selection of method of treatment.

Aim: aim of this study is to observe treatment of unstable distal radius fracture by closed reduction and percutaneous pinning among old age. **Patients and Methods:** prospective study for analysis of 30 patients above age of 50 suffering from distal radius fracture and managed by closed reduction and percutaneous pinning in Aswan university hospital. After acceptable reduction of the fracture was achieved, two or more percutaneous K-wires were inserted through the distal radius with the wrist in traction to maintain the reduction. All cases were assessed by Gartland and Werely score and by radiological assessment. Patients were followed up for a period of about 6 months.

Results: the majority of cases were women (70%). Majority of the patients (76.6%) sustained the injury due to fall. The side of involvement was predominantly the right side (60%). According to scoring system of cases; NO excellent results (36.7%), scored Good (50%), scored Fair (13.3%), and scored Poor at the end of 6 months follow up.

Conclusion: closed reduction and percutaneous pinning of distal radius fracture can considered as a satisfactory treatment in old age group and doesn't give an excellent results after short period of follow up.

Keywords: Distal radius fracture, Closed reduction, Percutaneous Kirschner wire fixation, geriatrics.

INTRODUCTION

One of popular surgical options for unstable distal radius fractures is closed reduction and percutaneous k-wires with or without external fixation ⁽¹⁾. Also open reduction and internal fixation (ORIF) with dorsal, volar and fragment specific approaches ⁽²⁾.

Comminuted fractures of the distal end of the radius are usually caused by high-energy trauma in young patients and by low-energy trauma in the elderly, and presents as shear and impacted fractures of the articular surface of the distal radius with displacement of the fragments ⁽³⁾. An articular step of > 2 mm will result in painful radiocarpal arthrosis ⁽⁴⁾. A persistent dorsal tilt results in incongruity in the distal radioulnar joint (DRUJ), and changes in the transfer of force with dorsal overload and secondary carpal bone disease⁽⁵⁾. Non-operative treatment was producing too many unsatisfactory results, up to 30% in large surveys ⁽⁶⁾. In elderly VLP, but not k-wires fixation, can maintain surgically corrected ulnar variance in distal radius fractures, independent of the degrees of initial ulnar variance. VLP enhances earlier recovery in range of motion and grip strength than k-wires⁽⁷⁾. This technique minimize morbidity in the elderly population by successfully handling osteopenic bone, allowed early return to function, provided good final results, and was associated with a low complication rate⁽⁸⁾.

PATIENTS AND METHODS

This is a prospective study for thirty patients above age of fifty suffering from distal radius fracture.

All patients were treated by closed reduction and percutaneous pinning with k-wires in Aswan University hospital in the period between April 2017 and May 2018.

Inclusion criteria

Inclusion criteria were sustained a fracture of the distal radius (extra-articular and intra-articular), they were over the age of fifty years, the patients presented within 2 weeks of injury.

Exclusion criteria

Exclusion criteria were open fracture with a Gustillo-Anderson ⁽⁹⁾ grading greater than 1, fractures which require open reduction / ligamentotaxis (external fixator).

A. Preoperative:

1. History:

Personal history: Name, Age, Sex, Occupation, Dominant side.

Past history: Details of previous disease or injury to the affected wrist and history of present symptoms:

1. Complain: Pain, swelling, finger anesthesia
Mechanism of injury:

1. Fall outstretched on hand, Road traffic accident, others.

2. Clinical examination:

Throughout examination of ipsilateral elbow and shoulder was done.

Wrist examination:

Neurological examination: median-ulnar nerves.

Vascular examination: capillary refill.

3. Investigations:

Routine Laboratory tests e.g. CBC, Renal and liver functions.

Radiological evaluation: Plain X-rays; PA and Lateral views.

CT (if needed).

First aid treatment:

The fractured limb was splinted in a cockup splint.

- Analgesic and anti-edematous measures were given.
- Patients were put under observation in the hospital till time of surgery with controlling of any associated medical condition.

B. Operative:

Surgical procedure:

Surgery was done under general or brachial block anesthesia and received prophylactic antibiotics within one hour of surgery. The patient is positioned in a supine position on a standard operating table. The patient's hand, wrist and forearm are prepared and draped.

Surgical technique:

The patient was placed in the supine position. An accurate reduction of the fracture was the first step in the treatment plan. A neutral position of the wrist was desirable. With a dorsally displaced fracture, the reduction was performed by pushing the distal fragment distally and palmar while holding the proximal fragment with the fingers around the forearm.

Image intensification fluoroscopy was used to assist the reduction and to assess the accuracy of the reduction. After acceptable reduction of the fracture was achieved, two percutaneous K-wires were inserted through the radial styloid in divergent manner with the wrist in traction to maintain the reduction.

Image intensification fluoroscopy was used to assist the insertion of the K-wires throughout the entire procedure. The wires were drilled proximally through the radial styloid until they penetrated the intact cortex of the shaft. K-wires with a diameter of 1.5 to 2.0 mm were selected for use, with smaller wires for women and larger wires for men.

The wire insertion was performed with a power K-wire driver to allow the surgeon to hold part of the reduction with one hand during K-wire insertion dressing was applied cotton padding then plaster.

C. Postoperative protocol & Follow up:

Post-operative analgesia is given up. Patient was encouraged to begin active finger movements as soon as the effect of anesthesia wore out. The limb was kept strictly elevated for a period of 2 days, postoperative plain x-ray: P-A and lateral view for radiographic evaluation.

Radiographic assessment:

- ❖ AP view & Lateral view

The patient discharged at the day after surgery after given instructions and date of follow up.

Final assessment and Follow up:

- First visit was after 2 weeks to check reduction, cast loosening, pain degree.
- The second visit after 5 weeks for cast and wire removal check x-ray for reduction, handgrip, wrist, and finger exercise, and physiotherapy consultation.
- Third visit after 24 weeks for radiological assessment as mentioned before and for clinical assessment.

- **Clinical assessment:** All patients were assessed by **Sarmiento *et al.*** ⁽¹⁰⁾ modification of demerit point system of **Gartland and Werley** ⁽¹¹⁾ table (1).

Table (1): Functional analysis **Sarmiento *et al.*** ⁽¹⁰⁾ modification of demerit point system of **Gartland and Werley** ⁽¹¹⁾

Prominent ulnar styloid	1
Residual dorsal tilt	2
Radial deviation of hand	2 – 3
Point range	0 – 3
Subjective evaluation	
Excellent – No pain, disability or limitation of movement	0
Good – Occasional pain, slight limitation of motion, no disability	2
Fair – Occasional pain, some limitation of motion, feeling of weakness in the wrist, no particular disability if careful, activities slightly restricted	4
Poor – Pain, limitation of motion, disability, activities more or less markedly restricted	6
Objective evaluation	
Loss of dorsiflexion	5
Loss of ulnar deviation	3
Loss of supination	2
Loss of palmar flexion	1
Loss of radial deviation	1
Loss of circumduction	1
Loss of pronation	2
Pain in DRUJ	1
Grip strength – 60% or less of opposite side	1
Point range	0 – 5
End result point ranges	
Excellent	0 – 2
Good	3 – 8
Fair	9 - 20
Poor	21 and above

D.

E. Statistical analysis

Statistical analysis was done using SPSS version 24.0 with statistical significance level of 5% ($P < 0.05$) For statistical analysis of the collected data, descriptive statistical methods (mean, \pm standard deviation) and

independent samples T test will be used for comparison of quantitative data. And Chi-square test will be used for comparisons of quantitative data.

F. Ethical and Approval statements:

The study has been approved by the Ethical Committee of Faculty of Medicine, Aswan University. Informed consent with risk explanation has been obtained from all participating patients. Patients were free to refuse participation in the study without affecting the service or the clinical management. They have been free to ask any question about the study. Privacy and confidentiality of all data were assured.

RESULTS

The majority of cases were women. (70%) Majority of the patients (76.6%) sustained the injury due to fall. The side of involvement that was predominant is the right side (60%).table(2) According to scoring system cases NO excellent results (36.7%) scored Good (50%) scored Fair (13.3%) scored Poor at the end of 6 months follow up (table 3).

Table (2): demographic data.

		Number of cases	Percentage
Sex distribution	Male	9	30%
	Female	21	70%
Mode of Injury	Fall	23	76.67%
	RTA	5	16.70%
	Other	2	6.70%
Side Involved	Left	12	40%
	Right	18	60%
Associated Injuries	No	27	90%
	Yes	3	10%

Table (3): subjective evaluation

Subjective evaluation		End result
Number of cases		Number of cases
Excellent	0	
Good	16(53.3%)	11(36.67%)
Fair	9(30.0%)	15(50%)
Poor	5(16.7%)	4(13.33%)

Postoperative data:

❖ **Postoperative radiographic evaluation:**

a. Radial height:

The mean radial height post-operative was 11 with SD± 1.2.

b. Radial inclination:

The mean radial inclination post operatively was 18 with SD± 3.8.

c. Palmar inclination:

Postoperative mean palmar inclination was 11.3 with SD±6.2.

d. Ulnar variance:

Interpretation of 2nd day post-operative x-rays reveal 18 cases with neutral ulnar variance and 12 cases with negative ulnar variance.

❖ **Post-operative complication**

Post-operative complications were counted in six cases. Four cases had pin tract infection that eradicated with antibiotics in all cases through follow up. Two cases had loss of reduction and refused revision, two cases had carpal tunnel syndrome, and one had superficial radial nerve numbness (Table 4).

Table (4): Post-operative complication

Post-operative complication	NO.	Management	Percentage
Pin tract infection	4	antibiotics	13%
loss of reduction	2	refused revision	6.60%
Carpal tunnel	2	corticosteroid injection after complete union	6.60%
Superficial radial nerve numbness	1	nurotonics	3.30%
Total	6	-----	20%

Difference between mean of radiological parameter post-operative and after 6 months follow up: table (5)

Table (5): mean radiological parameter post-operative and after 6 months follow up.

Mean radial height		Mean radial inclination		Mean palmar inclination	
post-operative	Follow up	post-operative	follow up	post-operative	follow up
11	8.33	18	14.6	11.3	9.6

Radiological parameters after 6 months

a. Radial inclination:

Mean = 14.6 SD ± 6.57

According to T- test there is statistically significant relationship between radial height and functional score r (28) = .709, p < 0.001.

b. Ulnar variance:

The sum of number and percentage of cases according to ulnar variance had been calculated as in illustrated in the following table (6):

Table (6): distribution according to ulnar variance.

	Neutral	Negative	Positive
Cases	17	3	10
Percentage	56.7%	10.0%	33.3%

c. Palmar inclination:

The mean palmar inclination was = 9.6 with SD \pm 7.5 and by T-test there is statistically significant relationship between palmar inclination and functional score $r(28) = .778$, $p < 0.003$.

d. Radial height:

The mean radial height was 8.033 with SD \pm 3.46 and according to T-test there is statistically significant relationship between palmar inclination and functional score $r(28) = .661$, $p < 0.006$.

Final score:

The mean of the score for cases treated by K-wires and cast was 12.23 with SD \pm 6.354 According to scoring system cases Good cases was 36.67%, Fair cases was 50% and Poor cases was 13.3%

ILLUSTRATIVE CASE

Female patient, 63 years old, housewife, FOSH, with type C1 fracture of Rt distal radius, managed by closed reduction under general anesthesia and percutaneous k-wires, wires are removed after 1.5 month, patient scored good figure (1, 2, 3).



Figure (1): Pre-operative x-ray

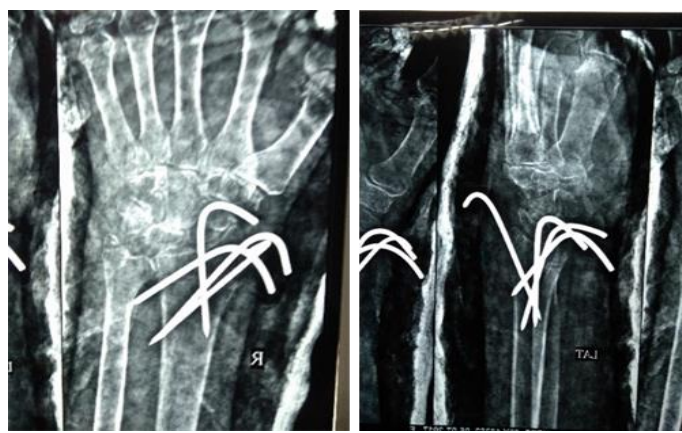


Figure (2): 3-week Post-operative x-ray



Figure (3): 4 months postoperative

❖ **Follow up complication:**

Follow up complications were encountered in 5 cases mainly arthritis.

DISCUSSION

Distal radius fracture is common among geriatrics and old age people. usually comminuted distal radius fracture, particularly in the old osteoporotic patient, represent a difficult management problem without an obvious surgical answer. It is also representing one-sixth of all fractures in the age group above 50⁽¹²⁾.

Dorsal comminution and significant displacement is considered as unstable fracture⁽¹³⁾. The traditional treatment of distal radius fractures in osteoporotic patients is closed reduction and immobilization in cast. this is method avoids surgery and related complications, but casts cannot maintain the length and rotation of the distal fragment particularly with comminution.⁽¹⁴⁾ Loss of reduction usually occurs after two weeks of initial closed reduction⁽¹⁵⁾.

usually 51.4% showing unsatisfactory result with closed reduction and cast in the treatment of comminuted interarticular fracture of distal radius⁽¹⁶⁾.

Other authors have suggested that the final functional outcome in old age patients with unstable DRFs has no direct relation to the radiographic outcome, and conservative methods had a satisfactory outcome⁽¹⁷⁾. non-operative management for fractures of the distal radius in low-demand patients older than 60 years, in study by Young and Rayan found that no correlation between radiographic outcomes and functional outcomes.

Most of these included in that study were high-risk medically fragile patients with multiple comorbidities. Six of 10 were with intra-articular fractures developed progression of radiocarpal and distal radioulnar joint arthrosis. Only two with radiographic signs of arthrosis had an unsatisfactory clinical outcome. Persistent nerve symptoms were present in three of 25 patients (12%). a clinical deformity (prominence of the ulnar head) was present in 14 of the 25 evaluated patients (56%). None of the patients were dissatisfied with the appearance of the wrist. Gartland and Werley score revealed 22 patients (88%) with excellent to good results and three patients

(12%) with fair or poor results. One patient developed a complex regional pain syndrome.

In other 14 studies (1306 patients) were in a review study, 10 of which were prospective. A percentage of (50.5%) of patients underwent volar locking plating, while (49.5%) were treated with k.wire. No differences were found regarding ROM, grip strength, radiographic parameters and rate of complications. The conclusion was that no significant difference between ORIF over k-wires (18).

In other studies, 95 patients treated by closed reduction and cast with mean age of 69 years with comminuted distal radius fractures. Two cases had a pin-track infections and four cases had a complex regional pain syndrome. 87% of patients had good or v. good Gartland scores, one poor result with persistent regional pain syndrome. Three of them had suffered from impaired hand function. Eighty-five percent had less than 10° dorsal tilt and less than 6 mm radial shortening after 28 months.

In a prospective randomized study of 90 distal radius fractures patients with a mean age of 65 years. They had noticed no difference in satisfaction rate and functional outcome (Gartland score). External fixation maintained radial length better at 2 years with more rate of pin tract infection. The authors conclude that there was no final difference between these treatment methods. Both had a complication rate of 45%.

In other study of 100 patients, the Kapandji K-wire method was compared with oblique radioulnar pinning with a mean age of 65 years. Results were found to be good to very good (using Martin score) for patient treated with the Kapandji K-wire method and satisfactory to good for patients treated with the oblique radioulnar K-wire method. Kapandji K-wires groups had better outcome after ten months follow-up. The complication rate was 30% in both methods, which mainly nerve irritation and wire migration. (19).

In our study Evaluation of closed reduction and percutaneous pinning as a method of treatment of distal radius fracture in elderly patients:

We treated thirty patients with 63.7 years using this method. The mean of the score was 12.23 using Gartland & Werley score with SD ± 6.354 According to scoring system. NO excellent result Good results was 36.3% Fair was 50% & Poor was 13.3% evaluation of radiological parameters results significant correlation between palmar inclination radial height, radial inclination and the final functional score with p-value ≤ 0.05 .

There were decrease in different radiological parameters values at the end of follow up as compared to post-operative values, although it is still accepted. We recommend adding external fixator to highly comminuted fractures as previous studies show its superiority in preserving radial height values after two years.

Distal radius fracture in elderly usually came as isolated injury (90%) this attributed to mechanism of

trauma which usually falling on outstretched hands, which is low energy trauma (76.76%). Most similar studies reveal better functional score than our study we can explain this by defect in compliance regarding physiotherapy by patients and short period of follow up (6 months). Actually, most patients continue to improve after 6 months and the patients will have better results after 2 years as noticed by other studies. We had a complication rate of 20%, which is acceptable rate, and most complication can be treated easily. Most of our patients had been returned to their usual daily activity. Choosing method of fixation in distal radius fracture among elderly population requiring careful estimation of biological age of patient, his daily requirements and fracture pattern. The rate of recovery and limitations of daily living activities during treatment affect the quality of life for patients with distal radius fractures. In contrary with younger patients, the elderly experiences a delay of about 6 months in final functional outcome (20).

CONCLUSION

Distal radius fracture is common fracture in elderly osteoporotic individual, usually low energy trauma. It's more common in females than males and can affect wrist and hand function tremendously. Closed reduction and percutaneous k-wire fixation is cheap and less invasive procedure that can give satisfactory results in elderly low demand population. Most complications are due to loss of normal parameters. Shortening of radius is more disabling than an angulatory deformity of the distal radius. Nonunion is extremely rare complication. There is no strong relationship between patient satisfaction and functional score or radiological parameters in this age group. ORIF may give early good result and return to activity but the results Semmes nearly similar after long follow up.

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